NASA Facts

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Walter C. Williams Research Aircraft Integration Facility

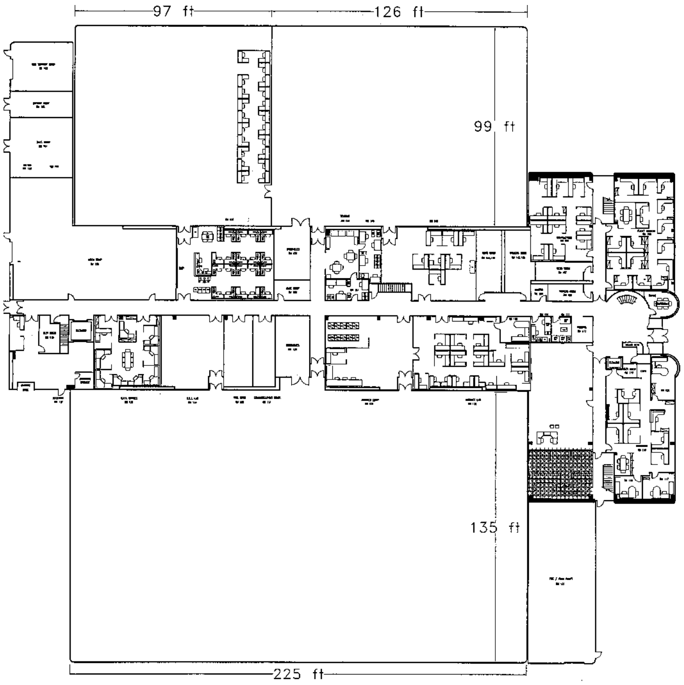
EC96 43773-1 *RAIF building*

NASA Dryden's Research Aircraft Integration Facility was officially opened under the name of Integrated Test Facility (ITF) on October 24, 1992. It was renamed the Walter C. Williams Research Aircraft Integration Facility (RAIF) on November 17, 1995. Williams was the first director of what later became the NASA Dryden Flight Research Center (DFRC) located on Edwards Air Force Base at Edwards, CA. The test facility allows researchers and technicians to integrate and test aircraft systems such as flight controls, avionics, electrical systems, and other related systems simultaneously before each flight. Flight test confidence is greatly enhanced by qualifying inter-active aircraft systems in a controlled environment. In the RAIF, each element of a flight vehicle can be regulated and monitored in real time as it interacts with the other aircraft systems. Until the ITF was developed, pre-flight checks were carried out independently and often at several locations.

The Building

The RAIF was built to accommodate a mix of commercial and fighter aircraft of various sizes at one time. The RAIF significantly reduces aircraft systems checkout time and costs at Dryden.

The RAIF is a 120,000 ft^2 multi-story building. It contains six test bays in three separate areas. Test bays one, two, and three are located behind a single door that is 50 ft high and spans 225 ft. The combined size of these test bays is 225 ft wide by 135 ft deep, large enough for a single transport-size aircraft to be placed in the multiple-bay area. On the opposite side of the structure, test bays four and five have a common door that is 40 ft high and 126 ft wide. Test bays four and five together are 125 ft wide by 99 ft deep. The door to test bay six is 40 ft high and 100 ft (30.48 m) wide. Test bay six is 97 ft wide by 99 ft deep. A full-height wall separates test bays five and six.



First floor plan of RAIF.

Located in the central section of the RAIF are the test systems used to carry out the automated test and integration functions. Each test bay is linked to a second-floor control room overlooking that area.

Aircraft services, including electrical systems, a central hydraulic system for each side of the building, and central cooling air are required during systems integration and functional checks. With the exception of engine runs all inflight aircraft functions that simulate real flight can be carried out in the RAIF.

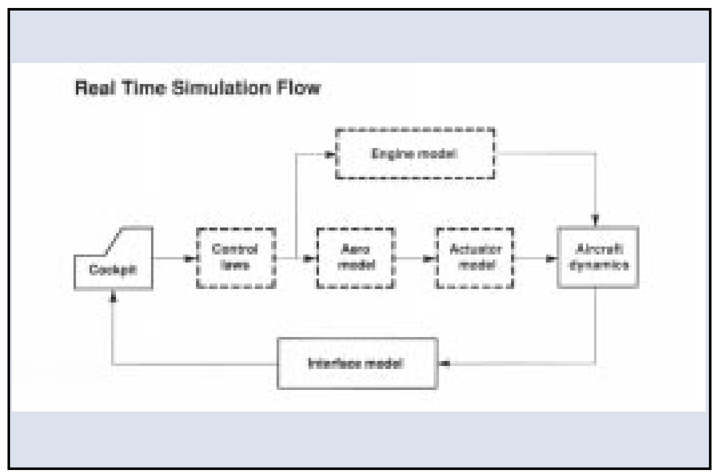
EC97 43027-02 *RAIF test bay.*

The front two-story section of the building contains offices for project management, engineering and administrative personnel.

Design and construction cost of the RAIF was $22.5 million.

RAIF Functions

Key to ground test operations in the RAIF is the ability to perform real-time simulation with the actual flight vehicle, “fooling” the vehicle into thinking it’s flying.



Simulation flow chart.

Testing in the RAIF is carried out through automated techniques in which each aircraft is interfaced to a high-fidelity real-time simulation. The process is controlled by an engineering workstation that establishes initial conditions for the test, initiates the test run, monitors its progress, and records and stores data generated. The workstation also analyzes results of individual tests, compares results of multiple tests, and produces reports.

Computers used in the automated, aircraft-testing process also are capable of operating in a stand-alone mode with a simulation cockpit, complete with its own instruments and controls. Development and modification of control laws; qualification of aerodynamic, propulsion and guidance models; and flight planning — functions traditionally associated with real-time simulation — also can be carried out in this manner.

Workstations provide test engineers with computer-aided test tools, minimizing the time required to qualify new flight software.

EC97-44008-01 *Pilot Steve Ishmael at simulator.*

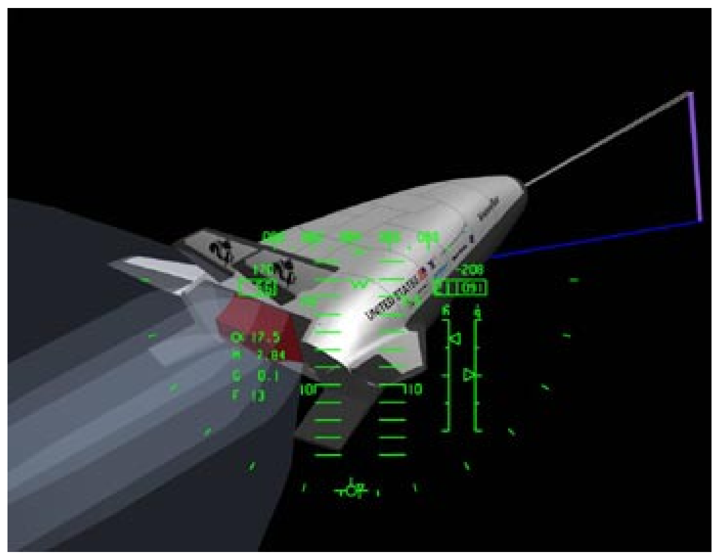
The RAIF is data-linked to Dryden's mission control rooms and other facilities. This gives researchers and engineers real-time comparisons of flight and simulation results and allows for immediate clearance of flight test points. This same capability also provides realistic training for mission controllers.

Simulation

Simulation systems in the RAIF support many configurations for each project, with varying levels of aircraft hardware included.

Simulations are used for a variety of research purposes such as determining time histories, frequency responses, conducting redundancy management tests, failure modes and effects tests, and pilot evaluations. Simulations also support pilot training, flight-research mission planning, and report writing.

Current simulations as of early 1998 included the following aircraft: X-33, Hyper-X, Eclipse, Apex, F18, F-15, F-16XL, and the High Speed Civil Transport.



Simulator display of X-33.

Ground Vibration Test

Ground vibration test (GVT) systems, formerly located in the Dryden Flight Loads Laboratory (FLL), are now in the RAIF. As research aircraft are prepared for certain flight programs, it is necessary to measure and test their strength to withstand vibrations. This ensures structural integrity and safety through all phases of flight research.

Support Staff

The RAIF is staffed by an experienced research team of technicians and engineers with backgrounds in all phases of flight simulation, flight control verification and validation, control theory, aircraft structures, electromechanical hardware design and fabrication, and remotely augmented aircraft operations.

The facility is the only one of its kind in the United States. It is considered a national aerospace research asset that is available for use, under specific agreements, by other government agencies and U.S. aerospace companies.

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